# Journal

OF THE NATIONAL ASSOCIATION OF CHIROPODISTS

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VOL. 44, NO. 9 SEPTEMBER, 1954

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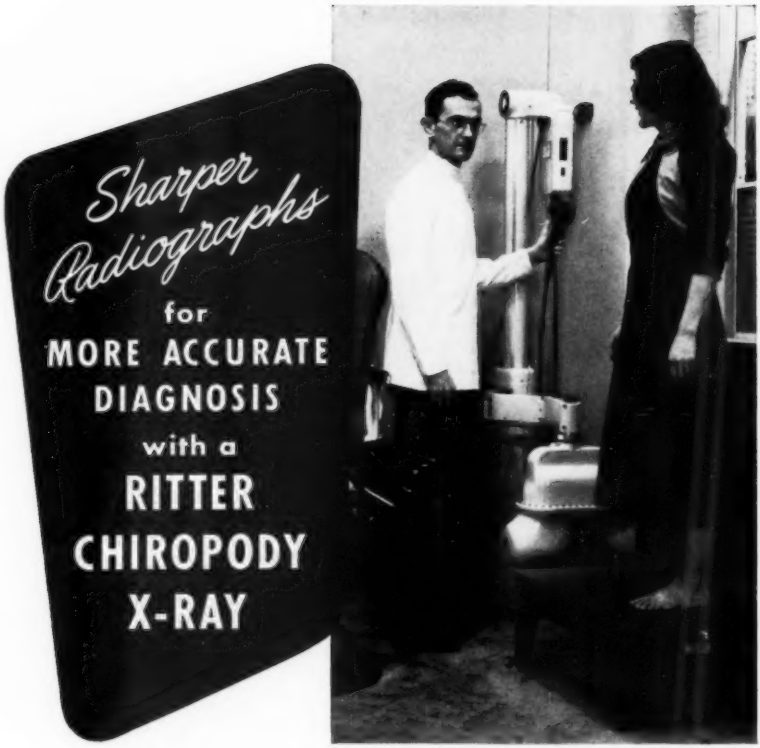


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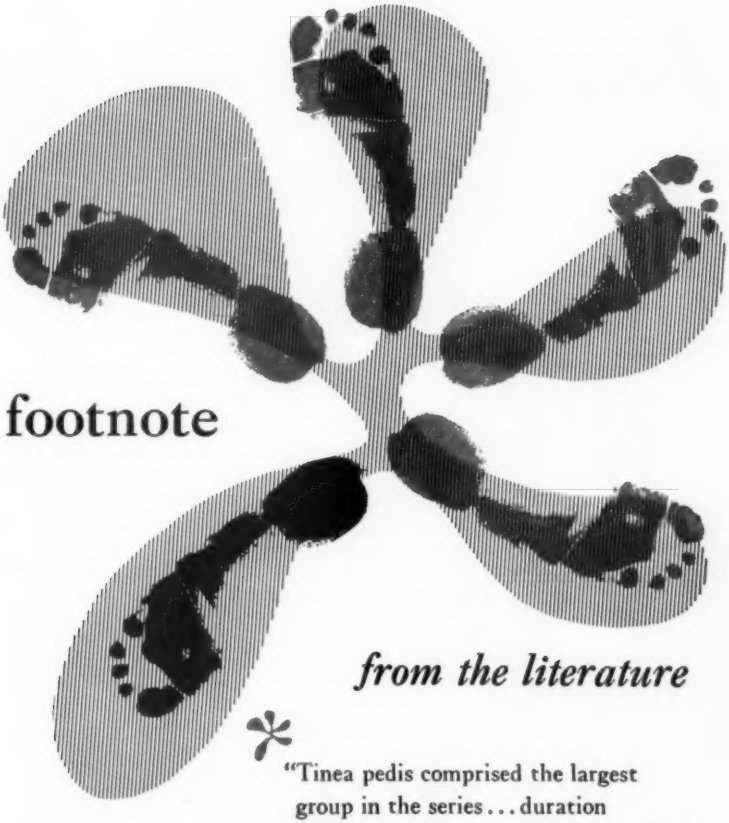

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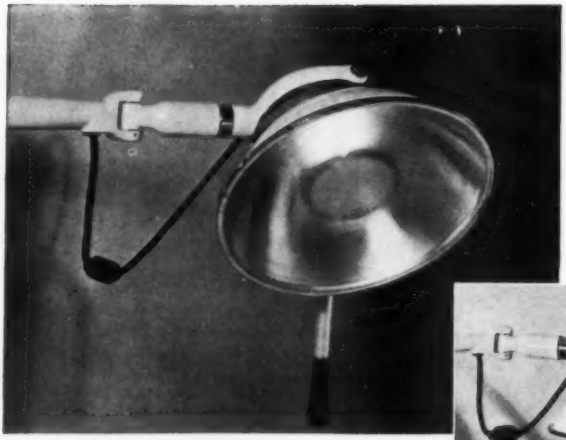

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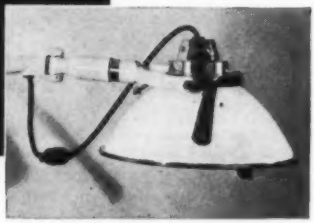

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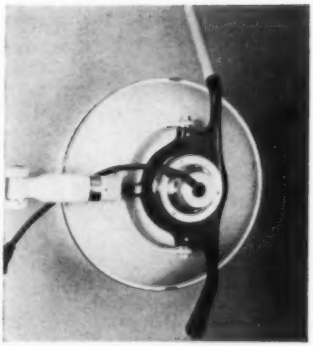

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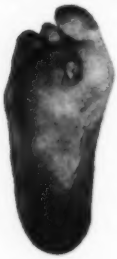

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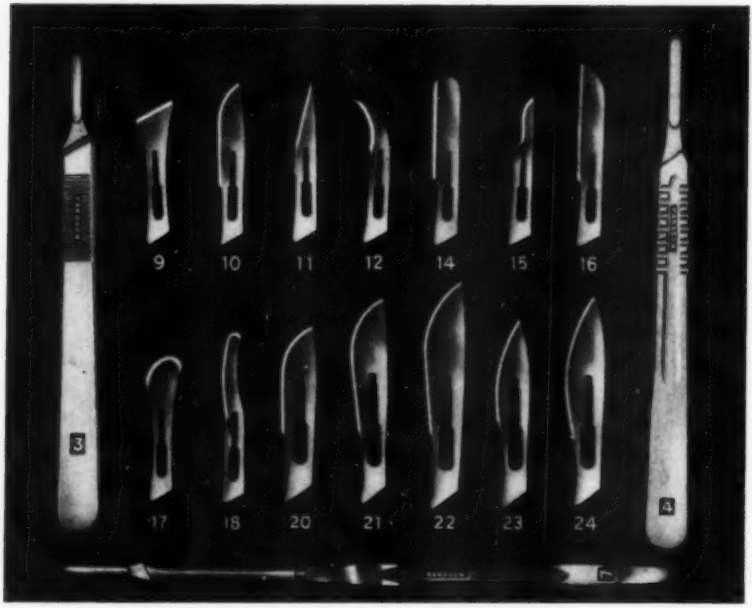


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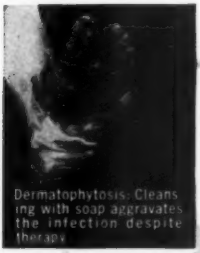

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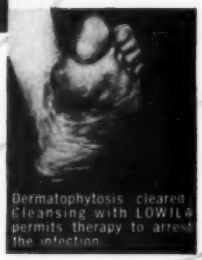

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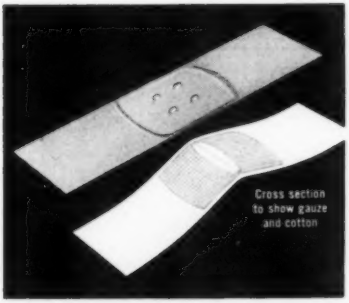


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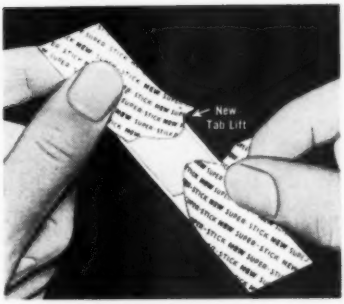


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VOLUME 44 SEPTEMBER, 1954 NUMBER 9

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# THE DIAGNOSIS AND TREATMENT OF FOREFOOT DISTURBANCES

HAROLD R. BURKHEAD, D.S.C.
Berkeley, Calif.

THE diagnosis and treatment of common foot disabilities is not an exact science. The practitioner who attempts to acquaint himself with the literature on the subject finds many conflicting opinions concerning the normal and the abnormal as well as the manner in which the abnormal should be treated.

When one considers the variation in muscle tone, ligament tension, walking surfaces, types of footwear, and the numerous ways the foot is used in stance and locomotion, one can readily realize that any set procedure in the diagnosing and treatment of feet is not feasible. We can, however, classify the majority of common foot complaints without ignoring the minority whose etiology is more obscure. The purpose of this article is to propose a basis by which a practitioner may diagnose and treat some of the more common forefoot complaints with better than average success.

## Etiological Factors

A brief summary of the etiology is presented so the reader may better understand the reasoning used in the suggested treatment.

Environment is a contributing factor to common foot complaints. Walking barefoot on a yielding surface has several marked advantages in maintaining a symptom free foot.

1. Yielding surfaces do not offer as great a counter pressure to the weight-bearing portion of the foot as do hard or unyielding surfaces.
2. When bringing the foot forward during locomotion, the toes dorsiflex to avoid trauma. When dorsiflexion of the toes occurs there is a simultaneous contraction of the peroneus longus which stabilizes the medial side of the foot at the first metatarsal cuneiform joint. Although the foot is not bearing weight at this phase of the step, the constant use of this muscle contributes to its tone which in turn helps maintain the medial longitudinal arch when the body weight is imposed.
3. When walking on a soft surface, the toes are extended to create a maximum area to counter the yielding soil; this is followed by a vigorous plantar flexion of the toes which adds to the drive forward during the final phases of the step. With a strong plantar flexion of the toes, the metatarsal heads are elevated and pressure at these points is diminished.

Our modern urban life has made walking on anything but a hard surface somewhat of a rarity and the wearing of protective foot gear a necessity. Muscular effort for locomotion is at a minimum and we are not encouraged to dorsiflex the toes for they are protected and splinted by our shoes. Frequently the foot is placed in a shoe that allows only a minimal use of the digits, therefore individuals with weakfoot tend-

encies do not receive the benefit that is offered by a more powerful peroneus longus and the plantar flexors of the toes.

The diminished use of the plantar flexor of the toes places an increased burden on the metatarsal heads and the relative lengths of the metatarsals have an important clinical significance. A foot with abnormal variations in the metatarsal lengths is not necessarily a symptomatic one for extensive use of the digital flexors will compensate satisfactorily. A foot with abnormal metatarsal length is more subject to certain forefoot disturbances as digital power is diminished. The individual becomes more dependent on a rocking motion off the heads of the metatarsals to propel himself forward. When an imperfect arc exists across this fulcrum, forefoot disturbances will occur at areas of greatest pressure.

### Examination for Mechanical Forefoot Irregularities

No attempt will be made to describe a complete examination, but some of the more pertinent diagnostic details of forefoot disturbances are reviewed.

*Skin:* Note the exact location of each callus and especially the point of its deepest or thickest portion. Differentiate calluses caused from excessive pressure or friction from those resulting from dry skin. If callus has not formed, look for hypertrophied skin striations or bursitis at pressure points.

*Palpation:* Dorsiflex toes to tighten plantar fascia. Run thumb down plantar fascia. Ruptures in this structure from stress beyond its normal tolerance will result in small nodules. Plantar flex toes to relax plantar fascia when palpating for ligament tenderness. Special attention should be given to plantar ligaments of the first metatarsal cuneiform articulation and at the medial middle cuneiform joint.

To check mobility of first metatarsal the following has been used and has proved a highly satisfactory method. Grasp the foot firmly with the index finger extending over the dorsal surfaces of the cuneiforms and cuboid bones. The web between the index finger and the thumb is adjacent to the medial surface of the first cuneiform. The thumb extending transversely across the plantar surface of the styloid process of the fifth metatarsal. With the other hand, grasp the shaft of the first metatarsal and work the base in a dorsal plantar motion. The amount of pressure to be used will become apparent with practice as in testing any other joint for abnormal motion. Crepitus at the first metatarsal cuneiform and possibly the first and second cuneiform articulations can be elicited in most cases when a hypermobility exists.

By forcing all the toes in plantar flexion, one can usually gain an impression of the relative lengths of the metatarsals.

*Gait:* For practical purposes we prefer the parallel position of the feet in locomotion when medial longitudinal arch weakness is a factor. Our reasons for this will be stated briefly.

1. When the foot is in a toe out position on locomotion, the thrust forward is primarily off the medial side of the foot. When the thrust forward is performed with all of the toes paralleling the line of progression, the extra burden is relieved from the medial segments and the combined power of the plantar flexors is put to more efficient use.

2. Only the more rigid feet tolerate a toe out position on locomotion when subjected to extensive use.

3. Toeing out increases the work of the flexor hallucis but lessens the amount of work performed by the flexor digitorum muscles. At the same time the extensor muscles controlling the lateral portion of the foot increase their action by first lifting the lateral portion of the foot from the walking surface. One might speculate that the decreased activity of the flexor digitorum longus and the brevis with the increased activity of the extensor digitorum longus and brevis would eventually result in a muscle imbalance and be a contributing factor in the contraction of the second, third, fourth, and fifth toes.

### Interpretation of Findings

*Calluses:* Location of calluses on the plantar surface of the foot can result from one of the following structural abnormalities.

1. *First metatarsal head:* A long first metatarsal hypertrophied sesa-

Fig. 1. Short fourth and fifth metatarsals.

Fig. 2. Long second or short third and fourth metatarsals.

moid or an excessively stable first metatarsal as is found in rigid pes cavus feet.

2. *Second metatarsal head:* A short first or third metatarsal or a hypermobile first segment.
3. *Third metatarsal head:* A short second or fourth metatarsal.
4. *Fourth metatarsal head:* A long fourth metatarsal.
5. *Fifth metatarsal head:* Weight is frequently carried on lateral side of foot. This may be from habit or subconscious effort to avoid strain on the medial longitudinal arch. Shoes are usually fitted from first metatarsal phalangeal joint to the heel. When long first and short fifth metatarsals are in combination, the result may be that the fifth metatarsal rides on the shank of the shoe and pressure is increased at this point. A callus at fifth metatarsal head will frequently be found in combination with a callus under first metatarsal head. This will occur when the anterior transverse arch is maintained during weight bearing and fails to allow the

**Fig. 3. Short second metatarsal.**

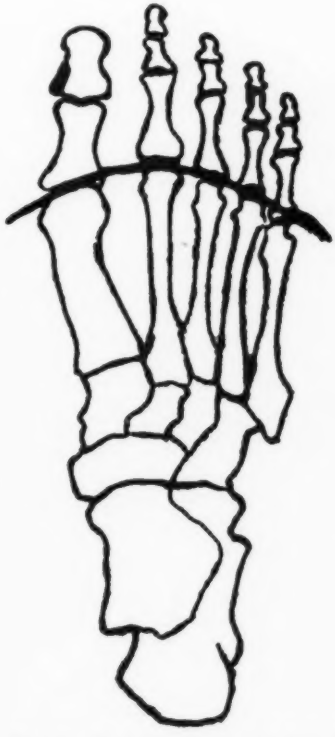

**Fig. 4. Best functional metatarsal lengths.**

second, third, and fourth metatarsals to carry their allotted share of the body weight.

6. *Calluses under all metatarsal heads:* Occur most frequently in the pes cavus type feet. In cavus feet the total body weight is concentrated on the tuberosity of the calcaneus and the metatarsal heads. This may be as little as thirty per cent of the plantar surface. The average foot uses approximately sixty per cent or twice that of some pes cavus feet. Atrophy of soft tissue beneath the metatarsal heads as in circulatory deficiencies and a body weight above the tolerance of the structures will contribute to this distribution.
7. *Callus at the medial-plantar aspect of the interphalangeal articulations of the first toe:* Results from a hallux valgus or toe in valgus position from out-toeing or pronation. With a hallux in the valgus position the final phase of the step will be made off the interphalangeal joint instead of the padded area beneath the distal phalanx.
8. *Linear type callus:* Caused by stocking seams and shoe insoles.
9. *Small imbedded callus on non-weight-bearing areas:* Heloma Milliare associated with dry skin.

*Palpation:* The ligamentous and fascial structures of the feet are not elastic by nature except for the spring ligament which does possess bundles of yellow elastic fibers. Any continued strain beyond the normal tolerance of these structures will render ligament tender to pressure. Crepitus on manipulation of the first metatarsal will usually be proportionate to the hypermobility of this bone.

### X-Ray Findings

*Metatarsal lengths:* To ascertain the best functional metatarsal lengths, draw an arc from the first to the fourth metatarsal. A metatarsal extending beyond this arc is considered long and one not extending to the arc is considered short. The exception is the fifth metatarsal which is normally short in most instances. When considering the musculature of this segment, it may be that its prime function is lateral balance and its secondary purpose is locomotion.

*Thickening of the cortical walls:* This can be caused by excessive stress and is a significant finding in confirmation of a tentative diagnosis.

*Cuneiform split:* The cuneiform split that is frequently seen between the medial and middle cuneiforms usually parallels the findings on palpation. Laxness of the first metatarsal cuneiform articulation is not seen in a dorsal plantar radiograph, but crepitus elicited on manipulation is usually in proportion to the degree of separation of the medial and middle cuneiforms.

Positive x-ray findings may be evident long before symptomatic complaints and may lend information toward future care of the foot.

### Treatment

Treatment must be practical in nature. First alleviate the pain, second, compensate for the immediate cause and third, encourage function by improving muscle tone.

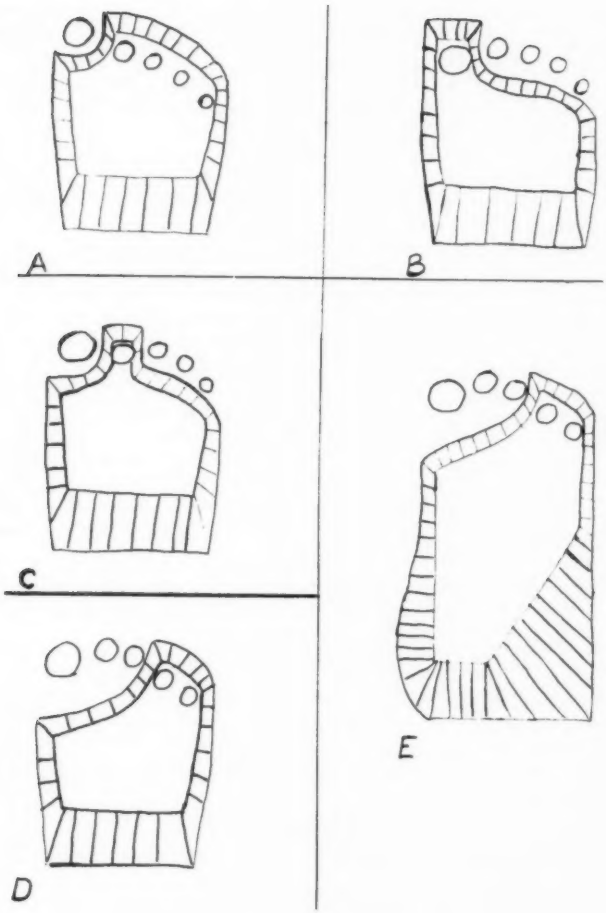


**Fig. 5. Compensation Pads.**

For rapid relief of painful calluses reduce the excrescences to relieve pressure on the underlying tissues. When acute foot strain symptoms are present the use of supportive adhesive strappings will offer the greatest amount of immediate comfort.

*Compensation Pads:* the principle of the compensation pad is primarily the use of the fulcrum. Padding is used to extend the fulcrum of short metatarsals and balance the contour of the forefoot. The extensions should be placed under the metatarsal heads for a sufficient length to compensate when the weight is on the distal ends of the metatarsal during the final phases of the step (see Fig. 5).

A. *Cut out pad for the first metatarsal head:* Long first metatarsal, hypertrophied sesamoids or excessively stable or symptomatic first metatarsal phalangeal joint.

B. *Morton's first metatarsal extension pad:* Used for short first metatarsal only. When hypermobility is combined with short first segments pad E is used. The use of the first extension pad in conjunction with a hypermobile first segment creates a greater stress on the already strained ligaments at the first metatarsal cuneiform and the middle medial cuneiform articulations.

C. *Extension pad for short second metatarsal:*

D. *Extension pad for short fourth and fifth metatarsal:*

E. *Combination pad* with longitudinal support and extension for short fourth and fifth metatarsals. The short fourth metatarsal in combination with the hypermobile first segment is one of the most frequent disturbances encountered. Statistics reported on March fractures show that the bones most frequently involved are the second and third metatarsals. It is not improbable that this combination may be largely responsible for this occurrence.

*Appliances:* the flexible moulded leather appliance has proved satisfactory in most instances. Appliances of this type should be made on a non-weight bearing cast. Longitudinal support is best determined after the leather shell has been moulded to the contours of the cast. Forefoot corrections should be in accordance with the severity of the condition and the size of the foot. Corrections should be in smooth flowing lines and abrupt edges avoided. To gain maximum foot comfort, appliances should receive the same care and consideration in their construction that is used in the preparation of dentures and lenses.

*Shoes:* the type of shoe that an individual should wear is in accordance with the type of foot structure and the activity engaged in. Patients with a weakfoot wearing a flexible appliance must wear a rigid shank shoe since without, the value of longitudinal support will be lost. The shape of the anterior half of the shoe should offer sufficient room for the toes to extend to their full length so that normal function in locomotion will not be impaired.

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*Medico Dental Bldg.*


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## GREAT MEN

GREAT men and insignificant men have like accidents, like vexations and like passions; but the former are on the outside of the wheel and the latter near the center, and therefore less agitated by the same movements.

*Pascal*

# DEFICIENCY AND DEGENERATIVE DISORDERS OF THE LOWER EXTREMITIES

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## Part I

THIS series presents an entirely new approach in our field to the deficiency and degenerative disorders. Even the routine treatment of excrescences results in limited benefits because deficiencies affect the integument and interfere with healing powers while stimulating keratotic accretions. Since in recent years the scope of practice among many of our clinicians has broadened, the time is at hand for a more comprehensive assessment of the complicating factors often negating otherwise sound therapeutic measures.

Radiology and other diagnostic aids have proved themselves in the field only to a limited extent. While these means of arriving at sound conclusions are essential in some cases in ruling out unfavorable systemic pathologies, or in arriving at a more accurate measure of local pathologies, such means do not rule out all deficiencies. The relation between the deficiencies and the degenerative disorders is not usually calculated when dependence rests heavily upon laboratory diagnostic methods for evidence of pathology.

The subnormal level of health of the American people as a whole is firmly established. It is interesting to note that most of the degenerative disorders affecting the lower extremities are those related chiefly to the circulatory tree. General health is largely related to deficiencies from early life, which do not leave their mark for many years to come. The feet seem to become the initial target for the manifestation of degeneracies. In such cases arteriosclerosis becomes a mark of the progressive nature of deficiencies that begin in the vascular system and eventually involve the cardiovascular apparatus.

In *Clinical Medicine* for July 1952, W. J. McCormick (Toronto, Canada) shows the relationship between cholesterol and atherosclerosis. He indicates that while it is quite true that a high level of cholesterol in the blood is generally associated with cardiovascular disease, it seems possible that this condition may be caused by an inability to assimilate this substance in the body rather than too much of it in one's food.

A deficiency of the B and C vitamins might result in liver damage so that cholesterol cannot be assimilated. Patients with high cholesterol blood content are usually advised to avoid liver, eggs, and other cholesterol-rich foods. On the other hand, when patients are given a diet ample in vitamins B and C in addition to desiccated or cooked whole liver, there is usually a dramatic decrease in blood cholesterol, in spite of this much larger intake.

### "Alpha Tocopherol in Cardiovascular Disease"

This is the title of a new type of textbook on a subject that should prove of absorbing interest to clinicians engaged in combating the large amount of degenerative conditions complicating other and lesser pathologies of the foot. This amazing book was written by E. V. Shute and his brother, W. E. Shute, together with six other contributors, under

the auspices of The Shute Foundation for Medical Research, London, Ontario, Canada, and printed by The Ryerson Press, Toronto, April 1954. One of the outstanding features to appeal to our clinicians is the inclusion in this publication of about 18 color photographs of the foot and leg of before-and-after cases of diabetic ulcers, ante partum phlebitis, arteriosclerotic gangrene, radiation, indolent, and perforating ulcers, etc.

Alpha tocopherol is the chemical name for vitamin E. In a later paper of this series some of the technical aspects of this substance will be set forth briefly. The need for vitamin E in human nutrition has not yet been established, but its need as a therapeutic agent of great potency is well established among the experts in medicine who are fully acquainted with its proper administration. With the possible exception of vitamin E made of natural oils, toxic reactions are common in cases of overdosage of all other vitamins.

There is considerable difference of opinion on the therapeutic value of vitamin E between the leading researchers and world clinicians on the one hand and the AMA on the other, according to a reprint of a report of the June 1947 meeting of the latter. However, it might be added that in the seven years that have elapsed since this dissenting opinion was adopted, the story today is much brighter in general. Any existing prejudice could be swept away by a scientific investigation into the field by open-minded clinicians.

As far as I am concerned with regard to the value of E therapy, I will continue to make good use of it in private practice. I have never seen a real need for drastic drugging in our field of practice. Personal observation is convincing enough to indicate that severe side effects are not worth the temporary palliation to smother deficiencies or degeneracies that in the long run either remain static or continue on a progressive course. Ultimate defeat can be the only reward, with frustration for all concerned.

It seems almost incredible that long-standing deficiency of tocopherol plays such an important role in the production of degeneracies in which the lower extremities seem to suffer proportionately more than any other part of the body exclusive of the cardiovascular apparatus. It has been shown by many clinicians and workers throughout 40 countries that vitamin E has exerted a genuine therapeutic effect in a large variety of diseases and disorders, many of which come within the field of our profession. It is of vital importance to our clinicians not to miss the boat when the available evidence in medical literature is so overwhelming.

### The Story of Vitamin E

Vitamin E was first studied in connection with fertility. One of the authorities on the subject (K. E. Mason, *Vitamins and Hormones, Academic Press, NYC)* states: "Its chemical nature is known, its laboratory synthesis accomplished, its wide distribution in the plant and animal world recognized and the effects of its absence extensively studied in a large series of laboratory animals. *Its physiological role in the animal body is still a matter of conjecture.*"

A number of years ago it was discovered that female rats on a diet of milk, yeast and iron were incapable of raising young. This aroused

interest in what substance might be missing in such a diet. Female rats conceive on a vitamin E deficiency diet, but the embryo dies and is re-absorbed into the body rather than developing and being born. Researcher Mason tells us that the cause of this misfortune is abnormality in the system of blood vessels, leading to thrombosis. As the blood vessels contract, there is anemia and finally hemorrhaging which causes the death of the fetus. Even though the anti-hemorrhagic vitamins K and C are administered, the embryo dies. Vitamin E supplies the missing substance in the diet, and conception and development of the embryo proceed normally if the diet contains ample E. In male rats permanent sterility results from a diet poor in E. Male chicks and guinea pigs also suffer degeneration of the testicles when they are deprived of vitamin E.

In the case of rats on diets that are low in E, litters can be born but the young rats often develop paralysis of the hind legs shortly after birth. This paralysis (similar to muscular dystrophy in human beings) spreads rapidly to other muscles of the body. No one knows what exact chemical process is involved, but there seems to be ample evidence that vitamin E is closely related to healthy muscles.

Another indication of the necessity for E in the diet came with the discovery that ample vitamin E protects the body's store of two other vitamins—A and C. Both of these vitamins are highly sensitive to the presence of oxygen and may lose much of their value over a period of time. But the presence of E in the digestive tract protects them from oxidation. From this it might be assumed that, all other things being equal, it would be necessary to take less A and C if sufficient E were taken at the same time.

### Experiments with Vitamin E

So far as human nutrition is concerned, experiments on E have been conflicting. How is it possible, it might be asked, that one group of researchers can perform an experiment in which E, when added to the diet, produces a certain effect, while another group of researchers might obtain exactly the opposite effect or even no effect at all? The answer perhaps lies in the great complexity of all the chemical aspects of testing a new vitamin. Scientist A, working over a period of many years, might be able to discover just one important scientific fact about vitamin E. Scientist B, working in another laboratory, might meanwhile be investigating some other aspect of E in human physiology. But all his work might be in vain if he performs it before Scientist A has proved his one fact. And when Scientist C uses A's method, he may get another result. If he uses B's method he may get quite a different result. And so forth.

In a valuable book by Dr. Walter Eddy (*Vitaminology*, Williams & Wilkins Co., Baltimore), he says of vitamin E and muscular dystrophy: "Some positive results have been claimed for vitamin E therapy in muscular dystrophy of certain types. Two are of particular interest in suggesting combination with other vitamin material for effective action.

"In 1940 Stone reported treatment with wheat germ oil of five patients with muscular dystrophy; one with muscular atrophy following anterior poliomyelitis; one with muscle atrophy after an attack of

multiple neuritis. He found: 'Definite improvement was obtained in all cases with muscular dystrophy, the improvement being manifested in gain in muscle strength, the disappearance of fatigue and muscle pain on slight exertion, change in muscle texture, and displacement of dystrophic musculature by normally contracting muscle . . . *the addition of vitamin B complex to vitamin E* appeared to increase the therapeutic efficaciousness of the latter.'"

A report in the *Texas State Journal of Medicine* for July 1952 disclosed that alpha tocopherol was used for a group of surgical patients to prevent thrombosis or embolism after surgery. It proved to be a sound precaution. This is not to infer that vitamin E will always prevent thrombosis, but it might simply mean that here we have one more piece of valuable evidence as to the place of E therapy.

The *International Record of Medicine* for July 1951 reports on the use of vitamin E therapy in cases of Buerger's disease. Of 18 patients treated, 17 were cured, one failed. It was found that medication must be continued indefinitely. Massive doses are indicated in all diseases involving blood vessels, and the exact dosage must at all times be tailored and the effects studied until neither too much nor too little is administered to accomplish the right result. If too little is administered, the results are nil.

In an article in *Science* for October 4, 1946, we are told that cattle on a diet deficient in vitamin E throughout their entire lives drop dead suddenly for no apparent cause. Does that not sound exactly like the mortality rate of heart disease of the American population? The question is: Can ample vitamin E in the diet of humans prevent this type of mortality, or reduce it drastically, as it does in the case of cattle?

The originators of vitamin E therapy for cardiovascular diseases, the Shute brothers, of London, Canada, conduct a practice in general medicine as well as their work in the cardiac clinic at The Shute Institute. They have made a deep study of vitamin E therapy and are meeting with excellent results. They study each individual case and prescribe and tailor the dose they feel will be most beneficial, then observe each patient carefully, changing the dosage or adding other medications, if indicated. Many other physicians have experimented with vitamin E therapy for cardiovascular disease without results. These failures result chiefly from a lack of technical knowledge of the potent therapeutic agent in their hands.

### Vitamin E in the Diet

Vitamin E is inactivated by rancid oil or fat. Some of the inorganic iron compounds destroy it. The use of ferric chloride for anemia is contraindicated. In the same way mineral oil destroys vitamin E along with the other fat-soluble vitamins in the digestive tract.

Nutrition books state that vitamin E is present in many foods. Actually, the food richest in vitamin E is wheat germ, which is not present in ordinary bread bought at the bakery or grocery. It appears to be no coincidence that heart disease mortality figures have climbed steadily during the past fifty years—that is, since we have been eating bread from which vitamin E has been extracted. The vitamin B complex—all of them in the group—are essential to good health. They are plentiful in the germs of wheat grains.

It appears from all the evidence about enriched bread as if these vital elements were replaced, but this is pure advertising bunk on the part of the huge bakery corporations. Much more is taken out than is ever replaced, and synthetic preparations are no real substitute for what only nature alone has manufactured, to say nothing of the poisonous chemicals added to the bread to preserve softness and artificial freshness. As the staff of life, bread no longer suffices. Deficiencies result from partaking of it regularly, whereas if it were eliminated from the diet completely, better health would be much more likely and systemic disorders of mysterious origin might become minimized.

But a lifetime of vitamin E deficiency is plaguing the American population. Cardiac disease is beginning to take its toll even on the youth, whose deficiencies are becoming more and more apparent. It is even possible that parents, already deficient in E and B complex, are passing these deficiencies on to their offspring. This familial link requires widespread investigation to determine the true facts.

Vitamin E is plentiful in food, "doubtless occurring very widely among food materials of both plant and animal origin which have not been artificially refined" (Dr. Henry C. Sherman, *Essentials of Nutrition*, The Macmillan Co., N.Y.). Almost all foods are refined, overprocessed, adulterated and vitiated of the essential elements for good nutrition, and in some cases harmful and poisonous ingredients added to make food that is more dead than alive.

There are five natural vegetable oils containing the greatest amount of vitamin E, given in the order of descending content: (1) wheat germ oil, (2) soybean oil, (3) cottonseed oil, (4) corn oil, (5) margarine. Other foods, such as fruits and vegetables, contain small amounts of vitamin E. Whole grain breads are a good source of the vitamin, while all other breads are worse than useless from the nutritional standpoint, and only help to accelerate the degenerative processes of the body. However, in the absence of whole grain products, fresh wheat germ is by far the best, since it represents the heart of the wheat in more concentrated form than found in whole grain bread.

It is a notorious fact that many professional people are victims of cardiovascular disease. Among these, physicians seem to be particularly prone. Executives and others who are under great stress and tension are also good candidates. Many members of our profession are no exception. The diet of these professional groups is perhaps only average when considered with the entire population, but the drain on the human organism of its vital energy and other elements of the life forces no doubt brings about faster physiologic reactions, resulting in the development of various degenerative processes at an earlier age than the average. This may also result in the vitiation of essential vitamins in the system, such as the entire group of the B complex and E, more rapidly than in the average person. Thus it becomes apparent that a greater intake of these vitamins is necessary to those professional groups who wish to avoid premature degenerative diseases from taking hold, cardiovascular disease in particular, the number one killer among the leading major scourges of American life.

Nutritional deficiencies and degenerative diseases and disorders there-

fore manifest in the lower extremities today more than was the case even as recently as a generation ago, judging by my experience in private practice. Routine cases aside, podosurgery and podoinstability (locomotor imbalance) are now often complicated by constitutional conditions which were comparatively rare a quarter of a century ago.

Beginning with 1920, when I embarked on my professional career and found myself growing into orthopedic practice more rapidly with each succeeding year, results were more easily obtained with far fewer complications than is the case today. In retrospect, I can add that experience over the years, as well as improved techniques in the field, has not reduced the rigors of present-day management of conditions related to podoinstability. On the contrary, when methods were crude and techniques unrefined, results came about with greater ease and little worry. Today, the involved techniques of examination and diagnosis alone are not conclusive enough to obviate the intangible complications into which many cases might run, and which are beyond the recordings of scientific instruments and laboratory findings.

*(To be continued)*

*130 W. 57th St.*

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## RESEARCH FUNDS

More than half of all scientific research and development in the U. S. is now sponsored and paid for by the Federal government. The National Science Foundation has analyzed the current Federal research subsidies to non-profit institutions and published a report which was summarized in a recent issue of *Science*.

Of the $1.9 billion disbursed for research and development by the Government (mainly the Defense Department and Atomic Energy Commission) last year, $338 million went to non-profit institutions, mostly large universities. A total of 225 schools did Government work, but five institutions accounted for 55 per cent of it; one institution (not named) got $70 million in Government funds for the year. Half the money went to "research centers," such as the Los Alamos Scientific Laboratory and The Johns Hopkins Applied Physics Laboratory. The NSF pointed out that work done in these centers is almost entirely military in character.

Some $71 million of the $338 million was allotted to basic research. Applied research took $170 million, and development work, $77 million. The physical sciences got the lion's share, 72 per cent, while 19 per cent went to biological science and 3 per cent to social science.

The NSF analyst raised these questions: Should universities do so much military research? Should the Federal funds be spread among more institutions? Is too much being spent in the physical sciences and too little in the biological and social?

*Science and the Citizen. Scientific American 189:40 August 1953.*

# NORMAL ARCH DEVELOPMENT IN THE CHILD

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The ability of the foot to maintain its longitudinally arched structure under the stress of weight bearing is not a characteristic normally observed in the foot of the child just beginning to walk. Rather, it is an aptitude which is attained only after a definite developmental cycle has been completed. Since such a cycle is a normal process, and further, since the recognition of abnormalities in the child patient must be based upon a thorough understanding of the normal procedure of development, it is vital that the metamorphosis undergone by the foot prior to its arrival at weight-bearing maturity be fully understood. It is the object of this paper to foster a better understanding of this interesting and important phenomenon.

The longitudinal arch of the foot is a bony structure, supported chiefly by certain pedal ligaments, by the plantar fascia, by the shapes of the bones comprising the arch, and to a lesser degree by the muscles of the foot and leg. This arched framework is placed in functional position by virtue of the synergistic action of certain specialized muscles of the lower extremity. Although most of the basic structures responsible for the maintenance of the longitudinal arch are innate in the neonatal foot, they do not, at this time, possess the correlated action that is necessary for maximum efficiency in their supporting roles.

As we have seen from the description already given, the anatomical elements concerned with arch formation and sustenance are as follows:

1. The bones which comprise the arch, and the contour of these bones.
2. Certain of the pedal ligaments.
3. The plantar fascia.
4. The muscles attaching to the foot and responsible for its motivation.

It must also be mentioned at this time that all of these structures must look for directional guidance from the nervous system, whose neuromuscular mechanism supplies the impetus responsible for the synchronization of those activities concerned with support and locomotion.

In order for us to fully understand the manner in which arch development normally occurs, it will be necessary to first consider the origin and expansion of the structures concerned with arch form and function.

The most important osseous elements concerned with arch formation are all present by about the sixth month of fetal life. These elements are as follows:

1. The calcaneus
2. The talus
3. The cuboid
4. The metatarsals

Of this group, the metatarsals are usually the earliest to form, followed by the calcaneus, talus, and cuboid, in that order.

In considering the osseous constituents of the arch and their developmental patterns, allowances must be made for variations due to race, sex, and disease. The negro displays more rapid ossification than does the caucasian, and females reach osseous maturity more rapidly than males. Disease may alter bone development either by accelerating the process, as is the case in hyperthyroidism, certain neoplasms of the male and female reproductive organs, and "obesity associated with statural overgrowth"; or by delaying the process as is observed in hypothyroidism, prolonged malnutrition, chronic illness, and the so-called "Frölich's Syndrome."[1]

While ossification of the foot is taking place, the ligaments, whose function it will be to maintain a normal relationship between the bones, are also in the process of development. These are actually elaborations of certain of the connective tissue elements forming the joint capsules. As ossification progresses, the young ligamentous tissue becomes imbedded in the bone areas adjacent to the joint, and thus assists in normal bone alignment and support.

The musculature which is concerned with foot form and function does not originate in the lower extremity as such. These muscles, together with their corresponding nerve elements have their embryonic origin in the "somites" mesodermal blocks which form along the neural tube. The somites are arranged in pairs, each pair giving rise to a vertebra, a pair of muscle segments, and a pair of spinal nerves. "The level of origin of a muscle is, therefore, indicated by the segmental level at which the nerve supplying it arises. Moreover, the path of the nerve in reaching the muscle suggests the path followed by the muscle in arriving at its adult location."[2] Thus it may be seen that the muscles of the upper portion of the lower extremity develop and are innervated prior to those of the distal end of the extremity. The muscles of the extremity are primarily evidenced by undifferentiated masses of mesenchyme at the dorsal and ventral aspects of the limb. Differentiation of those muscles concerned with the arch usually occurs around the seventh week of fetal life.

It is quite possible that a relative maturity of some lower extremity muscles, as compared with their antagonists, may strongly affect the position of the foot in utero, and thus also influence the arched conformation of the foot. Bechtol and Mossman[3] have offered some evidence to the effect that differences in the degree of maturity of certain embryonic muscle groups may be an influencing factor in certain cases of talipes. According to their observations, the deformity in these instances was in the direction of the more mature muscles, since quite obviously, these were capable of exerting a stronger pull upon the part. Further, in considering the action of muscles upon the intra-uterine foot, it must be realized that such muscular activity is being applied to the foot in the absence of the modifying influences of body weight and gravitational force. This situation tends to multiply the effect of muscle influence upon foot posture in utero.

Thus far in the discussion, we have said nothing about another important arch supporting element—the plantar fascia. Experiments on cadavers have shown that severance of the plantar fascia definitely decreases arch height. It therefore becomes apparent that here is a structure which must be considered in any treatise on arch development. Actually, the formation of the plantar fascia is probably similar to the

origination of other aponeurotic elements elsewhere in the body. In general, supporting tissues of this type arise as the result of degeneration of parts of the muscle segments. When such degeneration occurs, the sections involved are converted into tough connective tissue elements which support the adjacent muscle and bind other muscles together in groups.

From the foregoing, it is quite evident that the structures concerned with the formation and sustenance of the longitudinal arch are present prenatally. Consequently, the foot of the newborn must undeniably possess these elements as an inherent part of its composition. It must be remembered, however, that although these component portions of the arch unit are *present* at this time, they have by no means reached full maturity and maximum functional efficiency. We shall now consider the manner in which structural and functional maturity is finally achieved.

Just as the component parts of the arch are present at birth, so also is the longitudinal arch itself. Actually the foot becomes arched in appearance *prenatally*, about the third month of fetal life, when its position changes from pure extension to extension and inversion. From this point until birth, the chief alteration in foot posture is a gradual change from equinovarus to calcaneovarus. In other words, it is gradually forced up into flexion. It is probable that much of this movement takes place during the last few months of fetal life, when diminution of amniotic fluid and increased fetal size exposes the foot to a modifying pressure contact with the strong uterine wall.

Although the foot is arched at birth, the arch which is present is functionally immature and incapable of maintaining its shape against pronating forces. This may easily be demonstrated by placing the infant's foot on a hard surface and exerting pressure upon it. Pressure thus applied will immediately force the foot into pronation with a loss of arch height. The comparative ease with which pronation is accomplished in the neonatal foot suggests an inherent structural predisposition towards this postural attitude. Indeed, such predisposition does actually exist. It exists partly in the calcaneus, and partly in the relationship between this bone and the talus. Examination of the weight-bearing surface of the calcaneus reveals the fact that this surface is rounded. This anatomical peculiarity is helpful in permitting the bone to quickly alter its position under changes of weight-bearing stress. However, the rounding which is present in the calcaneal weight-bearing area when combined with the postural relationship between calcaneus and talus, actually encourages pronation. It must be remembered that the talus is *medially* superimposed upon the calcaneus. Thus, when weight-bearing stress is transmitted from talus to calcaneus, the normal reaction which results (in the absence of mature supporting structures) is an eversion of the heel. Such eversion is the primary step in the phenomenon referred to as pronation. So great is the pronating influence of this anatomical relationship between talus and calcaneus that full cooperation of the supporting structures is required to nullify it. Since such cooperation does not exist in the early weight-bearing foot, and further, since these same structures are at the time developmentally immature, the foot in a child of this age normally displays pronation when subjected to normal weight-bearing stress.

Fully cognizant of the functional defects inherent in the neonatal foot,

nature soon begins an organized effort to overcome these faults, and thus eventually produces a normal, efficiently functioning organ. Locomotive training for the foot and its superimposed extremity begins long before the actual process of locomotion itself. With the child's early postnatal movements of the lower extremity, the structural elements which will eventually support the body weight, and be responsible for its propulsion, begin to develop. Such development is not accomplished in the absence of obstacles. For some reason, the muscles on the medial aspect of the leg do not appear to reach maturity as rapidly as do those at the leg's lateral aspect. Examination of the infant's leg reveals the lateral muscle bulk to be greater than the medial bulk. Since bulk or size of a muscle or group of muscles is to some extent indicative of its relative strength and development, this relationship suggests an earlier maturity of the everters as compared with the inverters. This suggestion is also present in the child's early foot motions. The foot is usually everted more often than it is inverted, and flexion of the foot upon the leg is more often accomplished with the foot in eversion than it is with the foot in inversion.

Around the seventh month, the child begins to crawl. The foot, during such early locomotive attempts is abducted, and the leg externally rotated, so that the foot thrust in forward propulsion originates at its medial side. This factor tends to encourage more rapid development of the structures in this area with the result that the relationship between the inverting and everting muscles becomes more favorable to eventual arch maintenance.

Weight bearing and first walking comes for most children between the ninth and fifteenth months. This is of course a critical period in arch development. It is also the beginning of an era of considerable postural change owing to an increase in, and a change in the nature of, the functional demands placed upon the foot. Prior to this time, the chief functions asked of the foot were merely motion and some slight propulsion. Now, however, the additional demands of stance and propulsion in the presence of opposition from body weight and gravitational stress force the foot to change its function, and because of this, to alter its structure as well. Such a metamorphosis is of course conducted in accordance with the laws of Wolff and Davis.

Before stance and propulsion may be adequately accomplished, the child must first attain balance. This is done by widening his base of support. Consequently, the lower extremities of the child first beginning to stand and walk, are abducted and externally rotated, and the feet themselves are abducted and everted. Such a postural attitude offers maximum balance, but it also encourages and exaggerates foot pronation. Hence the foot of the child in this age group normally appears quite flat. This flattened appearance is further encouraged by the presence, on the plantar aspect of the foot, of a small fat pad. This pad is usually absorbed by about the second year, but while it exists it acts as a temporary support to the arched structure of the foot during a critical period in foot development.

The early weight-bearing stance of the foot forces the structures concerned with arch maintenance to assume maximum degrees of activity. In the normal, well-nourished child this situation tends to encourage these elements to greater power and efficiency, since the size and strength of given tissue is, within reasonable limits, governed by the amount of

work that it performs. Unquestionably, if such work is carried beyond the individual's fatigue threshold, or is conducted in the presence of general malnutrition or disease, the result will be detrimental to normal arch development. However, in the normal child, constant function in the manner described results in improved function, increased strength, and better coordination. As the result of these beneficial improvements, as well as to further bony additions to the arch which come with advancing childhood age, the ability to sustain the arched contour of the foot under weight-bearing stress is finally attained. This is no minor achievement, nor is it accomplished in short order. It is a goal that is usually reached by about the sixth or seventh year of life, after a long period of developmental struggle against great odds.

As a final thought in the consideration of normal arch development, brief mention must be made of the extrinsic factor of postural attitudes habitually assumed by the child in question. Frequently, positions used by the young child in sleep, repose and play are in no small measure responsible for strain upon the foot and extremity. Thus, "belly sleeping" with the feet adducted or abducted may encourage the production of pigeon toe, or pronation. Sitting in frog-like fashion upon the floor will often be a factor in persistent pronation, or knock-knee. There are a number of instances, similar to those just mentioned, where constantly employed attitudes of extremity posture will discourage normal development of the arch. The final analysis of arch formation and development in children must of necessity take such chronic attitudes into consideration.

From the foregoing, it is hoped that some knowledge of arch development in the normal child may be gained. It is quite certain that without such knowledge, abnormal variations in the arched structure of the juvenile foot can never be wholly understood.

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3. Bechtol, Charles O., and Mossman, Harlan W.: "Club Foot—An Embryological Study of Associated Muscle Abnormalities," Jour. Bone and Joint Surgery, Vol. 32-A, No. 4, Oct., 1950.



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## SCIENTIFIC RECORDS

WE must expect inferior science from those who cannot work at the great research centers, until mechanisms are developed to insure that every scientist, no matter where he may be, may have access to the record of science to the full extent to which it can contribute to his investigations.

*Science 108:148.*

# HYDROCORTISONE ACETATE OINTMENT IN TREATMENT OF IDIOPATHIC PRURITUS: A PRELIMINARY REPORT

ROBERT LAWRENCE, A.B., Pod.D.
Long Beach, N. Y.

THE problem of localized areas of the feet undergoing periods of severe pruritus is one which constantly confronts the chiropodist. The most perplexing type, that unassociated with any other symptoms (save those induced by scratching) has long evaded traditional methods of topical treatment. The applications most commonly used[1] have included topical applications containing menthol, phenol, camphor, benzocaine, pontocaine, nupercaine, starch and soda baths. Quite often it is the mechanical application of these materials that brings temporary relief rather than the dermatological medication itself.

Eight patients with non-specific pruritus were treated with hydrocortisone acetate ointment (supplied by Merck Co.) by applying the ointment lightly, without excessive pressure, to the pruritic area. Four of these patients were also treated with a placebo base, identical with the hydrocortisone acetate ointment insofar as vehicle components were concerned, but without the steroid. The following table summarizes the results:

| *Patient* | *Sex* | *Area* | *Result* |
|---|---|---|---|
| 1 | male | dorsum of foot | good |
| 2 | male | dorsum of foot | good |
| 3 | male | dorsum of foot | fair |
| 4 | male | side of foot | excellent |
| 5 | female | between toes | excellent |
| 6 | female | between toes and sole of foot | good |
| 7 | male | side of foot | good |
| 8 | female | dorsum of toes | excellent |

In those cases in which the results were "excellent," relief was obtained promptly and lasted for at least three hours after the application of the 2.5% ointment. Two of these patients were treated with a placebo vehicle with negative results. "Good" results indicate a period of relief for less than three hours. Two of these patients complained of a drying sensation in the area. One of them received an equal amount of relief from the placebo base. The one case with "fair" result received only a brief period of relief together with a definite feeling of dryness in the area.

*Discussion:* The basic mechanism of pruritus is believed to be[2, 7] the release of a histamine-like substance or histamine itself from mechanical injury to the cells. If the circulation in the area is arrested, the material is retained at the site of trauma and the itching persists. It is therefore concluded that the itching is due to the retention of the histamine-like substance in the area. Although histamine increases capillary permeability, this is only up to a point. After the onset of inflammation, capillary permeability decreases rapidly[3] and the materials exuded into

the area are retained. The action of the histamine-like substance must be offset. The direct action of adrenocortical steroids when applied topically is not fully understood, but a possible explanation might be made when we consider the antagonistic action that has been shown to exist between thesteroids and histamine[4]. When the adrenocortical steroids are applied locally to rats, there is a thinning of epidermis, atrophy of sebaceous glands and dermis and a general inhibition of skin metabolism in the area[5]. It must be remembered that with the sole of the foot, we are dealing with perhaps the thickest portion of the body epidermis. None of the aforementioned tests were made on the sole of the foot proper. A complete lack of data exists in regard to the use of hydrocortisone acetate ointment for the relief of pedic pruritus, but in view of the excellent results obtained in other areas of the body[6] together with the promising effects obtained in this preliminary report, further investigation and clinical trial might be undertaken by other practitioners.


### Summary

(1) Eight cases of non-specific pruritus of the feet were treated with hydrocortisone acetate ointment (2.5%) with good results.

(2) An attempt is made to explain the physiological mechanism of cortisone in relieving pruritus.


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1. Tobias, N.: Essentials of Dermatology, ed. 3, Lippincott, Philadelphia, 1948, p206.
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4. Perla, D. and Gottesman, J. M.: Effect of injections of cortin on resistance of suprarenalectomized rats to histamine poisoning, Proc. Soc. Exper. Biol. & Med. *28:* 650-3 (Mar.) 1931.
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6. Alexander, R. M. and Manheim, S. D.: The effect of hydrocortisone acetate ointment on pruritus ani, J. Invest. Dermat. *21:* 223-5, (Oct.) 1953.
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## SURGICAL LEADERSHIP

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*British Jour. Surg., Jan. 1954.*

# JOURNAL

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## REPORT — 42ND ANNUAL CONVENTION AND 35TH HOUSE OF DELEGATES

The 42nd Annual Convention was held at the Drake Hotel in Chicago, Ill., August 12-17, 1954. Dr. Walter C. Gigerich, Hot Springs, Ark., assumed office of president; Dr. Ralph E. Fowler, Detroit, Mich., was elected president-elect; Dr. Felton O. Gamble, Tucson, Ariz., was re-elected vice president; Dr. Jonas C. Morris, Audubon, N. J., was elected vice president; Dr. Edward C. Stivers, Louisville, Ky., was elected a member of the Council on Education.

Dr. Lester A. Walsh, Midland, Texas, and Dr. Philip Cogen, Greenville, So. Car., were elected members of the Board of Trustees of the American Foot Health Foundation.

Mrs. Virginia Collet of Des Plaines, Ill., was elected president of the N.A.C. Women's Auxiliary.

Honorary Membership was conferred on Dr. Paul Tarara, Rochester, Minn. Life Membership was conferred on the following: Dr. John G. Bricker, Sr., Richmond, Va.; Dr. Arnold Elson, Ligonier, Ind.; Dr. Clifford F. Roberts, Chicago, Ill.; Dr. Isaac Hoffman, Quincy, Ill.; Dr. William Lee, Baltimore, Md.; Dr. Emilie Pohlke, Milwaukee, Wis.; Dr. William J. Hicks, Madison, Wis.; Dr. Annie M. Halpin, Newport, R. I.; Dr. Mary P. Schell, Waterbury, Conn.; Dr. Margaret L. Flynn, Hartford, Conn.

Winners of the 1954 Awards for Research in Chiropody were announced as follows: First Award, Dr. Abe Rubin, Chicago, Ill., $400.00; Second Award, Dr. Raymond K. Locke, Englewood, N. J., $250.00; Third Award, Dr. Samuel Rosoff, New York, N. Y., $100.00; Fourth Award, Dr. Robert K. Bunch, Houston, Texas, $50.00; Fifth Award, Dr. Leo N. Liss, San Francisco, Calif., $50.00.

Retiring president Reed received an engraved plaque in appreciation of his splendid service to the N.A.C.

Amendments intended to alter the basis for representation in the House of Delegates and change the definition of a "member in good standing" were withdrawn. Two other amendments providing for a

vice chairman and authorizing the president to appoint an acting chairman and/or vice chairman of the Council on Education (if for any reason the duly elected officials were unable to fulfill their duties) were adopted.

Among the resolutions approved by the delegates were several providing for the organization of a National Association of Chiropodical Assistants; the American Association of Hospital Chiropodists was given affiliation as a specialty organization; endorsement of a proposed "National Association of Chiropody Students." A complete list of resolutions will be published in a near future issue of the Journal of the N.A.C.

A splendid scientific program was presented by Dr. Earl Kaplan, chairman of the N.A.C. Scientific Committee. The second annual American Chiropody Conference on Organization and Education featured a panel discussion comprising members of the Illinois Interprofessional Council, a unique group comprising representatives of medicine, dentistry, pharmacy, optometry, chiropody, and veterinary medicine. The Illinois Association of Chiropodists is a member of this body.

Many conferences were held by N.A.C. committees. Among them the Hospital and Institutional Service Committee which began organizing a program designed to assist practitioners in securing hospital and institutional affiliation. Dr. Hirschberg, chairman of the American Foot Health Foundation, rendered a detailed report on Foot Health Week and other activities sponsored by the Foundation. The Council on Education was in session for several days under the chairmanship of Dr. Max Speizman. The group adopted tentative regulations for conducting the activities of the Council and began work on revision of the "Essentials for Classification."

Affiliated organizations held special meetings before the regular N.A.C. program began. Among these were: The Military Association of Chiropodists; The American College of Foot Orthopedists; The American College of Foot Surgeons and The Chiropody Bibliographical Research Society.

A very successful program was conducted by the Women's Auxiliary under the direction of Mrs. Margaret Dobbs, national president, and Mrs. Virginia Collet, president of the Illinois Association chapter.

The National Conference on Chiropodical Nomenclature of Diseases and Operations was held. A detailed report on the work of this group was rendered by Dr. Peter N. Varzos, chairman of the Editorial Advisory Board. Dr. Rosemary Becker is editor. Mrs. Adaline C. Hayden, R.R.L., associate editor of the Standard Nomenclature of Diseases and Operations, which is sponsored by the American Medical Association, gave a detailed explanation of the program conducted by the group.

The initial meeting of the National Association of Chiropody Students was held during the N.A.C. convention with student representatives of the accredited colleges in attendance. Dr. M. D. Marr, chairman of the N.A.C. Organization Committee with the assistance of Dr. Edward Tarara, chairman of the N.A.C. Medical Relations Committee, supervised the proceedings and election of temporary national officers who are as follows: President, G. W. Anderson, Chicago College; Vice-President, Irwin H. Frank, Ohio College; Secretary, W. S. Burley, Chicago College; Treasurer, Wilbur Sault, Ohio College. A constitution was written and adopted for the association. Chapters will be formed in the near future in all the accredited colleges.

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# MEASUREMENTS OF THE HUMAN FOOT*

## A Literature Survey

FLORENCE H. COZZI
Philadelphia, Pa.

### Introduction

IT HAS been stated by the Roman poet Horace: "If it is well with . . . your feet, regal wealth can add nothing greater." Probably soldiers who have marched many miles in all the wars of mankind have re-echoed those thoughts often. Properly fitting shoes are as essential a part of a military man's equipment as his gun, for without them discomfiture prevents his rendering the maximum service, either in marching or in battle.

In order to have properly designed and comfortable fitting shoes it is important that the last sizes be formulated from accurate measurements. These sizes can be determined from a study of literature pertaining to measurements of large groups of individuals. Such a survey facilitates the making up of standard sizes based upon actual needs.

This bibliography was compiled in response to a request for a literature search on foot measurements, especially as applicable to military personnel in the United States and in foreign countries. References cover the years 1900-July 1952. Articles reporting less than 100 cases have been excluded.

All information refers to male and female individuals in the age groups covering the time at which they may enter military service until expected retirement age. All races and nationalities have been considered.

Abstracts are of material seen in the original in Philadelphia and Washington, D. C., libraries. References not abstracted could not be verified and their accuracy is not guaranteed.

Since the literature on foot measurements is scattered in a variety of sources it is hoped that this bibliography will serve to centralize a large segment of information.

The help of Mr. Francis D. Horigan in checking references not available in Philadelphia is noted with appreciation.

001 Air Force Material Center. Experimental Engineering Section. MEMORANDUM REPORT EXP-M-49-695,40. October 3, 1942. Contains charts showing average foot length and breadth. Gives techniques of measurement.

002 Air Material Command.
HUMAN BODY SIZE IN MILITARY AIRCRAFT AND PERSONAL EQUIPMENT.
Francis E. Randall et al.
AAF TECHNICAL REPORT 5501. June 10, 1946.
A description of anthropometric instruments and their use is given. Tables give the foot length and breadth of 2,959 male aviation cadets and 599 women aviation personnel. The mean total was approximately: male, length—10.5 inches, breadth—3.9 inches; female, length—9.56 inches, breadth—3.61 inches.

*Bibliographic Series No. 24, Technical Library, QM Research & Development Laboratories, Philadelphia. U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

003 Air Material Command. Engineering Division.
BODY MEASUREMENTS OF FEMALE FLYING PERSONNEL.
MEMORANDUM REPORT ENG-49-695-32A. Sept. 1, 1943.
One hundred and fifty-two U. S. Army nurses and 447 woman pilot trainees of the U. S. Army were the subjects. Techniques of foot length and breadth are given. Charts and tables show the results. The mean total for both forces was: (1) foot length—9.56 inches; (2) foot breadth—3.61 inches.

004 Armored Medical Research Laboratory, Fort Knox, Kentucky.
FOOT DIMENSIONS OF SOLDIERS.
SGO No. 611 (PROJECT T-13-3) March 1946.
A detailed analysis—including numerous charts, graphs and illustrations—of the feet of U. S. Army and Air Force personnel. The study covered over 6,000 white and 1,200 Negro subjects.

005 DIE VORDERE UMGRENZUNG DES FUBES AN DIE MASSENHERSTELLUNG VON SCHUHEN (Variability in Measurements in Relation of Mass Production of Shoes).
Adolf Basler.
ZEITSCHRIFT FUR ORTHOPADIE UND IHRE GRENZGEBIETE. 72.142-150 1941.
Contains illustrations of methods of measuring the foot and charts of results of studies.

006 THE RELATION OF VARIOUS ANTHROPOMETRIC MEASUREMENTS OF SELECTED COLLEGE WOMEN TO SUCCESS IN CERTAIN PHYSICAL ACTIVITIES.
Elizabeth Beall.
TEACHERS COLLEGE, COLUMBIA UNIVERSITY CONTRIBUTIONS TO EDUCATION No. 774, New York, 1939.
Gives length and breadth of foot of women engaged in various forms of physical activity.

007 EXPERIMENTAL MEASUREMENT OF BONES OF FOOT AS AN AID TO A BETTER DIAGNOSIS AND MORE RATIONAL TREATMENT.
B. Belove.
JOURNAL OF THE MISSOURI STATE MEDICAL ASSOCIATION. 14:13-19. 1917.
An experimental study giving details of measuring size of bones in feet as an aid to diagnosis of foot pathology. A chart shows average size of bones of both feet with and without superimposed weight.

008 NEW TYPES OF OLD AMERICANS AT HARVARD AND AT EASTERN WOMEN'S COLLEGES.
Gordon T. Bowles.
CAMBRIDGE, HARVARD UNIVERSITY PRESS, 1932.
The study included 364 selected women subjects attending Vassar or Wellesley. The subjects were mainly from New England families of Northwest European descent. The range of foot length on total sample was 7.0 cm.

009 SHOES AND FEET: A TEXTBOOK FOR STUDENTS AND PRACTITIONERS.

Frank J. Carleton.

WEST CHESTER, PA., ANDRESS PRESS. XXI.

Presents a practical consideration of 50 affections of the foot found in chiropodical practice, their relationship to shoes and their elemental therapy. The book contain chapters on the measurement and fitting of footgear; basic pads and strappings for common affections of the foot; corn formation, hardening and thickening of bursal inflammations; joint deviations and exostoses. Consideration is also given to certain malformations incompatible with stock lasts; variations in foot contour which prevent the application of free fit from stock lasts; inaccuracies inherent in the fitting of several million feet from a few thousand stock lasts, and incompatibilities of foot and last which can be rectified or modified.

010 ANTHROPOMETRY OF AMERICAN MAN.

E. Garcia Carrillo.

MEDICINA DEL DEPORTE Y DEL TRABAJO (BUENOS AIRES) 11:804. May 1947.

011 PHYSICAL MEASUREMENTS OF OLD AMERICAN COLLEGE WOMEN.

Isabel Carter.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY.

A report of measurements of college women. About 204 subjects were used. Seventy-nine per cent were Old American. Tables of locality of origin, ethnic derivation, and of change in stature after age 16 are given. The foot length, breadth and index are shown in tabular form. All parts of the body were measured and are reported.

012 ADDITIONAL ANTHROPOMETRIC OBSERVATIONS ON THE CHOCTAW.

Henry Bascom Collins.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY 11 (2) :353-355. 1928. (B. A. 3:9768. 1929).

A chart shows left foot length, width and foot index of males and females.

013 SIZE AND FORM OF THE FOOT IN MEN.

Gunnar Dahlberg and Elvir Lander.

ACTA GENETICA et STATISTICA MEDICA. I. 2:115-162. 1948-1949. (IN ENGLISH.)

Subjects used in the study were 8,232 Swedish conscripts aged 17-47. Eighty and 5/10 per cent were 21. The study is made for the express purpose of giving accurate information to determine accurate shoe sizes to meet military needs. Measuring techniques are described and a chart of foot measurements is given. Extensive tables are presented containing such information as the standard errors of measurement for the different measurements and angles, the distribution of foot length, the distribution of deviation of foot measurements, the range of varia-

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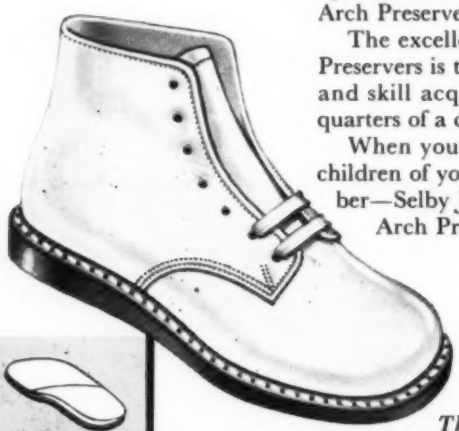

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tion of different measurements, the geographical and occupational distribution of foot sizes. Details of each graph are fully discussed. It is pointed out that a study of this type enables the manufacturer to produce the sizes in proper proportion of demand.

014 THE GROWTH OF THE HUMAN FOOT.

Charles Benedict Davenport.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 17:167-211. 1932.

Results are based on a study of over 200 boys at Letchworth Village and 100 boys and 50 girls at an orphan asylum. There is no important change in the foot index of the Nordic race between 6 and 16. Negroes have a smaller foot index as they have longer feet.

015 CRITICAL EXAMINATION OF PHYSICAL ANTHROPOMETRY ON THE LIVING.

Charles Davenport and William Drager.

PROCEEDINGS OF AMERICAN ACADEMY OF ARTS AND SCIENCES. 69:265-284. 1934.

Charts of foot length are given on page 271.

016 CRITICAL EXAMINATION OF PHYSICAL ANTHROPOMETRY ON THE LIVING.

C. B. Davenport, Morris Steggerda and William Drager.

PROCEEDINGS OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES. 69:265-284. 1934.

017 ANTHROPOMETRISCHE UNTERSUCHUNGEN IN EINER STUDENTENGRUPPE DER SUN YAT SEN UNIVERSITAT MIT BESONDERER BERUCKSECHTIGUNG IHRER BEDEUTUNG FUR DEN SPORT (Anthropometric Researches of a Group of Students of the Sun Yat Sen University with Special Consideration of Their Significance for Sports).

Ernst Dormanns.

ABHANDL. MED. FAKULT. SUN YAT SEN UNIVERSITY. (CANTON). 2:1930-1-17.

018 THE STATISTICS OF THE HUMAN ARCH WHEN SUBJECTED TO BODY WEIGHT.

H. H. Dunn.

MILITARY SURGEON. 52:567. 1923.

Data was obtained from 108 males and 1 female, military and civilians were used. Methods of measuring the foot are given. The data is used mainly to determine the function of the arch in supporting body weight.

019 THE HUMAN FOOT.

Thomas Ellis.

WOOD'S MEDICAL AND SURGICAL MONOGRAPHS, Vol. VI. N. Y., WILLIAM WOOD, 1890. 81-84.

In describing how to make boots to give proper fit, a method of measuring the foot is discussed.

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020 Gaud, J. et al.
BULL. INST. HYG. MAROC 8, 35, 1948.

021 ANTHROPOMETRY OF THE COMANCHES.
Marcus Goldstein.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 19:289-320. 1934.
On pages 309-310 a chart shows a comparison of the length, breadth and index of Comanches with these same elements of the Southwest and Mexican Indians, Old United States whites and the Sioux.

022 OLD AMERICANS OF THE SOUTH.
Harley N. Gould.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 21:57-86. 1938.
Dr. Hrdlicka suggested this subject. Two hundred college women of Old American stock were measured. A chart showing mean foot length, breadth, index and mean foot module over mean stature is given. Separate tables for each part of the body include foot length, breadth and index with frequencies at each size.

023 Great Britain. Flying Personnel, Research Committee.
A FURTHER INVESTIGATION OF SOME OF THE EFFECTS OF MARCHING IN FLYING BOOTS, EXERCISE ORTHOPOD II, 14th, 15th, 16th July, 1950, January 1951.
Foot volumes were measured using the water displacement method. Volume of right foot only was measured.

024 THE MEASUREMENT OF MAN.
J. A. Harris et al.
MINNEAPOLIS, UNIVERSITY OF MINNESOTA PRESS, 1930.
Page 49 gives correlations, in graph form, of length of foot and other body measurements.

025 THE SAN BLAS INDIANS.
Reginald G. Harris.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 9:17-63. 1926.
This is a report of a study of 46 albino Indians in Panama. Measurements were made of the foot by outside tracings for breadth and length. Extensive charts are given of individual and group results.

026 CONCLUSIONS DRAWN FROM A COMPARATIVE STUDY OF THE FEET OF BAREFOOTED AND SHOE WEARING PEOPLE.
Phil Hoffman.
AMERICAN JOURNAL OF ORTHOPEDIC SURGERY. 3:105-136. 1905-6.
Measurements were made of foot length and of expansion when body weight supported the organ. Footwear attempts to modify the appearance of the foot; however, the relative foot

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size of the shoe wearing and non-shoe wearing is practically the same. One hundred and eighty-six subjects were used. All but five were non-shoe wearers. Later 200 white and 100 black shoe wearers were used as controls.

027 GROWTH DURING ADULT LIFE.
Ales Hrdlicka.
PROCEEDINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY. 76:847-897. 1936.
Charts are published on the relation of age to foot length, breadth and index in males and females, of whites and Indians. Only the index shows a slight increase.

028 THE OLD AMERICANS.
Ales Hrdlicka.
BALTIMORE, WILLIAMS AND WILKINS, 1925.
*Page 330 — The Foot.* A detailed discussion with charts and graphs of variability of foot length, breadth and index, frequencies of size, relations of size of foot to stature and comparative sizes between Americans, immigrants and foreign people living in their native lands. Male and female subjects were used. The foot continues to grow slightly during adult life.

029 PRACTICAL ANTHROPOMETRY.
Ales Hrdlicka.
PHILADELPHIA, WISTAR INSTITUTE OF ANATOMY AND BIOLOGY, 1939. 97-98.
Describes method of measuring length and breadth of foot.

030 ANTHROPOMETRY.
Ales Hrdlicka.
PHILADELPHIA, WISTAR INSTITUTE OF ANATOMY AND BIOLOGY, 1920. 31, 79, 141.
The method of tracing the foot is described as contained in the International Agreement for the Unification of Anthropometric Measurements to be Made on the Living Subject. A detailed description of instruments used is given and a chart showing what bones of the foot should be measured. This is an explanation of anthropometric methods.

031 MAKING THE FEET FOR MILITARY SERVICE.
Arthur S. Jones.
MILITARY SURGEON. 41:219-230. 1917.
Ability to march is determined almost completely by the training of the foot and kind of footwear it uses. Army regulations prescribe the kind of shoe and the method of measuring the foot. A table showing how to determine size is included. Number of men inspected was 30,359. A method of measuring the foot is given. Included is a letter from Leonard Wood, MG, Chief of Staff, demanding that officers personally oversee the job of properly equipping with shoes the men of their command.

032 A BIBLIOGRAPHY OF HUMAN MORPHOLOGY.
Winton M. Krogman.

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CHICAGO, UNIVERSITY OF CHICAGO PRESS. 1941.

Applicable references have been abstracted from the original in the body of this report.

033 GROWTH OF MAN.

Winton M. Krogman.

CHICAGO, UNIVERSITY OF CHICAGO PRESS. 1941.

By and large, the greater number of references to the anthropometrical measurements of the human foot are related to feti, infants, and children. One section, however, deals with surface areas of the foot in square centimeters as measured by coating methods. Measurements are given of experimental data performed by American, British, German, Chinese and Japanese scientists.

034 MIGRATION AND PHYSICAL DIFFERENTIATION: A COMPARISON OF IMMIGRANT WITH AMERICAN-BORN CHINESE.

Gabriel W. Lasker.

AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 4:273-300. 1946.

Measurements of Chinese males, born and raised in the United States, differ from Chinese born in China. Foot indexes tend to be lower in the American-born. The feet tend to be more slender. Charts are included.

035 SOME GENERAL PROBLEMS REGARDING COLLECTION AND ANALYSIS OF ANTHROPOMETRICAL DATA WITH SPECIAL REFERENCE TO THE CHINESE FIELD.

Chi Li.

BULLETIN OF THE PEKING SOCIETY OF NATURAL HISTORY 3 (1) :I-IX. 1928.

036 A MANUAL ON FOOT CARE AND SHOE FITTING.

W. L. Mann.

PHILADELPHIA, 1920.

037 LEHRBUCH DER ANTHROPOLOGIE. LENA, 1914.

S. Martin.

038 HUMAN FOOT LENGTH FROM EMBRYO TO ADULT

H. V. Meredith.

HUMAN BIOLOGY. 16:207-282. 1944.

This report is a colligation of material from over sixty studies. Inhabitants of North and Central America only are included. Pages 242 begins a discussion of foot length in adulthood. Extensive charts are given on average foot lengths of women and men of white, Negro and Indian races. In general, in adulthood the Negro has the longest foot, the Indian the shortest. The review of the literature includes many direct quotations. The bibliography is extensive.

039 THE SOLDIER'S FOOT AND THE MILITARY SHOE.

E. L. Munson.

FORT LEAVENWORTH, KANSAS. 1912.

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040 ANTHROPOMETRY OF LONG DISTANCE RACE CHAMPIONS.
Wataru Nakagome et al.
JAPANESE JOURNAL OF EXPERIMENTAL MEDICINE. 10:509-520. 1932. (B. A. 7:21091. 1933.)
Study covers a group of champion long distance runners. Weight of foot increased slowly when subjects ran.

041 Naval Medical Research Institute.
FOOT DIMENSIONS OF 1,500 NAVAL RECRUITS IN RELATION TO SHOE DESIGN.
Otto N. Schuster.
REPORT No. 3. PROJECT X-279. December 30, 1946.
The method of measuring the right foot of 1,500 naval recruits is given and a table giving standards is provided. Illustrations show how the foot was measured.

042 THE ANGLE OF GAIT IN WOMEN.
Sadie D. Patek.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 9:273-291. 1926.
Measurement of the foot length of 150 women chosen at random from gymnasium classes at Stanford University, age range 16-27, was made using a specially constructed pedometer. Both feet were measured in each position of sitting and standing. Foot length was taken from acropodion to pternion. A chart shows results.

043 QM Board. Fort Lee, Virginia.
FINAL REPORT OF TEST OF CLARKE'S UNIVERSAL MEASURER. QM BOARD PROJECT T-104. January 19, 1943.
Report shows a comparative study of various types of foot measuring devices and their relative accuracy.

044 QMC Research & Development Division. Environmental Protection Branch.
SURVEY OF BODY SIZE OF ARMY PERSONNEL, MALE AND FEMALE. REPORT NO. 122, PHASE I, REPORT NO. 1, METHODOLOGY. October 1951. (PROJECT NO. E-59-46).
Detailed illustrations show the method of measuring the foot as well as other parts of the body.

045 QMC Research & Development Division. Environmental Protection Branch.
REFERENCE ANTHROPOMETRY OF ARMY WOMEN.
Francis E. Randall and Ella H. Munro.
ENVIRONMENTAL PROTECTION SERIES REPORT NO. 149. March 31, 1949.
Pages 135-140 give ball foot circumference, instep, foot breadth and length and heel breadth of approximately 8,000 WACs and Army nurses.

046 QMC Research & Development Division. Environmental Protection Branch.

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ANTHROPOMETRY OF THE FOOT (U. S. ARMY WHITE MALE).
Francis E. Randall, Ella H. Munro and Robert M. White.
ENVIRONMENTAL PROTECTION SERIES REPORT NO. 172. January 1951.

Gives information on a survey of the feet of 5,575 Army white men at Fort Knox. This is an analysis of the report as originally published. Ball length and ball girth are the most important factors to consider in determining shoe size. Charts of various foot measurements are included.

047 QMC Research & Development Division. Environmental Protection Branch.
REFERENCE ANTHROPOMETRY OF ARMY MEN.
Russell W. Newman and Robert M. White.
REPORT NO. 180. September 1951.

Pages 122-126 contain tables showing ankle circumference, ball foot circumference, foot breadth, heel breadth and instep length of approximately 25,000 U. S. Army male separatees.

048 QMC Research & Development Division. Environmental Protection Branch.
ANTHROPOMETRIC NOMOGRAPHS.
Ella H. Munro.
REPORT NO. 184. February 1952.

To aid designers of Army clothing these nomographs were prepared. Page 17 contains a nomograph of the foot of U. S. Army white males developed from U. S. Army files of information.

049 QMC Research & Development Division. Environmental Protection Branch.
DETERMINATION OF TARIFFS FOR UNIVERSAL MILITARY TRAINING: BOOTS AND SHOES.
MEMORANDUM REPORT NO. 31. May 21, 1948.

Gives data on foot length.

050 A REPORT ON A SURVEY OF BODY AND CLOTHING MEASUREMENTS OF ROYAL AIR FORCE PERSONNEL.
F. P. R. C. 633 (a), July 1946.

051 THE ANTHROPOMETRY OF THE POPULATION OF A LONDON BOROUGH (HORNSEY).
W. T. Russell.
JOURNAL OF THE ROYAL ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN AND IRELAND. 72:19-22. 1942.
(B. A. 20:4349. 1946.)

Foot measurements were collected on 1,205 adult males and 260 adult females. Foot length was determined by shoe size. In males, foot length averaged 10.12 inches; in females, 9.21 inches.

052 TALWAN IGAKKAI ZASSI. 40:1113. June 1941.
M. Sakai and M. Asai.

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053 THE HUMAN FOOT: ANATOMY, DEFORMITIES AND TREATMENT.
William M. Scholl.
CHICAGO, FOOT SPECIALIST PUBLISHING CO. 1915.
Attention is called to Chapter 40, page 318 et seq. of the present volume. Tables are given of measurements of standard shoe lasts for men's shoes ranging from size 6-12. Women's and children's shoe lasts are also considered. All measurements are made at either the ball, waist or heel of the foot.

054 ANTHROPOLOGICAL STUDIES ON NICARAGUAN INDIANS.
Adolph H. Schultz.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 9:65-80. 1926.
A table of percentage frequencies of foot breadth and lengths of Indians and whites is given. It is concluded that in the Ramas and Sumus tribes, the foot length is relatively long, and the foot index below average. Tables of absolute measurements and indices are given.

055 FOOT ORTHOPEDICS, second edition.
Otto N. Schuster.
ALBANY, N. Y., J. B. LYONS CO., 1939.

056 ANTHROPOMETRY AND PHYSICAL EXAMINATION: A BOOK FOR PRACTICAL USE IN CONNECTION WITH GYMNASTIC WORK AND PHYSICAL EDUCATION.
Jay W. Seaver.
NEW HAVEN, CONN., June 1909.
Contains extensive charts of detailed foot measurements and descriptions of various methods of taking foot measurements as determined by foot studies.

057 PHYSICAL MEASUREMENTS OF NEGRO, NAVAJO, AND WHITE GIRLS OF COLLEGE AGE.
Morris Steggerda.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 26:417-430. 1940.
The feet of the Navajos are smaller than those of the whites and Negroes in breadth and length but the indices of the Navajos are higher showing a broader foot than either of the other groups. A table shows comparative information on foot length, breadth and index.

058 BODY MEASUREMENTS ON 100 NEGRO MALES FROM TUSKEGEE INSTITUTE.
Morris Steggerda and Christine Petty.
RES. QUART. AMERICAN ASSOCIATION OF HEALTH, PHYS. ED. AND REC. 13:275-279. 1942.

059 ONE HUNDRED MEASUREMENTS AND OBSERVATIONS ON ONE HUNDRED SMITH COLLEGE STUDENTS.
Morris Steggerda, Jocelyn Crane and Mary D. Steele.

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AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 13:189-254. 1929.

060 BEOBACHTUNGEN AM SPORTTREIBENDEN WEIBLICHEN KORPER. (Observances on Body Measurements.)
B. Skerly.
DIE MEDIZINISCHE WELT. 10:1117-1123. August 1, 1936.
Gives information on the measurement of foot height in women.

061 ANTHROPOMETRY IN CHINA: AN EXTENDED OUTLINE OF RESEARCH.
Paul H. Stevenson.
CHINA MEDICAL JOURNAL. 40. 15:23-24. February, 1926.
Explains and illustrates methods of measuring the foot.

062 GROWTH OF THE HUMAN FOOT.
William Straus.
CARNEGIE INSTITUTE OF WASHINGTON, CONTRIBUTIONS TO EMBRYOLOGY. 19:93-134. 1921.
Gives a detailed account of the apparatuses used in obtaining foot sizes at various ages. Charts show the relative average foot width, length, phalangeal length, and foot leverage. Sixty-four humans and 49 anthropoid apes and monkeys were the subjects. The article is well appended.

063 DIE PASSIVE UND AKTIVE VERANDERUNG DER VORFUBBREITS UND IHRE MESSUNG MIT EINEN NEUEM MEBAPPARAT. (Active and Passive Changes in Forefoot Width and Its Measurement with a New Apparatus.)
W. Thomsen.
ZEITSCHRIFT FUR ORTHOPADIE UND IHRE GRENZGEBIETE. 71:182-189. 1940.
Describes and illustrates a device for measuring foot width.

064 DIE GESCHICHTE DER SCHUHREFORM.
Thomsen.

065 DIMENSIONS OF THE BODY: WHITES AND AMERICAN NEGROES OF BOTH SEXES.
T. Wingate Todd and Anna Lindala.
AMERICAN JOURNAL OF PHYSICAL ANTHROPOLOGY. 12:35-119. 1928.
Pages 74-78 discuss comparative data on foot length and breadth as it relates to leg length in Negro and white males and females. Charts of foot length and breadth are given. (Pages 111-112.)

066 U. S. Dept. of Agriculture.
MISCELLANEOUS PUBLICATION 78. May 1930.
Ruth O'Brien.
An annotated list of literature references on garment sizes and body measurements.

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067 U. S. Dept. of Commerce. Office of Technical Service
BIBLIOGRAPHY OF REPORTS ON ANTHROPOMETRY. IV. 124. March 1950.
A list of preferences, some of which are applicable to foot measurements. These are included in the body of this list of references.

068 A STUDY OF THE FOOT AND FOOTWEAR.
F. W. Weed.
MILITARY SURGEON. 30:170-211. 1912.
Pages 202-205 give measurements of Army shoes of the period, pointing out the weaknesses of the garrison shoe. A diagram shows points at which to measure the foot.

069 THE BODILY PROPORTIONS OF WOMEN IN THE UNITED STATES: BASED UPON MEASUREMENTS TAKEN FROM ONE HUNDRED SMITH COLLEGE STUDENTS.
Harris H. Wilder and Margaret W. Pfeiffer.
AMERICAN ACADEMY OF ARTS AND SCIENCES. PROCEEDINGS 59:574-576. 1924.

070 RUSSIAN METHODS OF DETERMINING SHOE SIZES FOR CIVILIAN.
Yu P. Zybin and A. A. Afanasieff.
LEZKAYA PROMYSHLENNOST. April 1947.
Describes method of arriving at average sizes by a study of the most requested sizes in various provinces.


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## WEST VIRGINIA ATTORNEY GENERAL OFFERS OPINION THAT HEALTH PLANS MUST INCLUDE CHIROPODISTS

HEREWITH is a statement from Mr. T. D. Kauffelt, Assistant Attorney General of West Virginia, concerning the inclusion of chiropodists in health plans operating in that state:

"We have your letter of May 4, 1954, in which you ask whether chiropodist comes within the meaning of the phrase, 'duly licensed physician,' as used in Chapter 31, Article 13, Section 3 of the Code of West Virginia, and if so, whether a medical service corporation licensed and operating under Chapter 31, Article 13, is required to include in any or all contracts offered by it, provisions authorizing services from chiropodists.

Chapter 31, Article 13, Section 3 of the Code of West Virginia reads, in part, as follows:

> "* * * Every duly licensed physician in this State shall be eligible for participation in the medical service plan operating in the area in which he resides or practices."

Is a chiropodist a duly licensed physician? The term, "physician," means one skilled in the art of healing. *State v. Borrah* (Ariz.), 76 P. 2d 757, 15 A.L.R. 254. In Webster's New International Dictionary, Second Edition, the word "physician" is defined as "one duly authorized to treat diseases, especially by medicines." It therefore appears that one skilled in the treatment of diseases and duly licensed to do so, falls within the term, "duly licensed physician."

In the case of *State v. Morrison*, 98 W. Va. 289, 127 S.E. 75, the court held that giving chiropractic treatment is practicing medicine and surgery, and, although not directly in point, strengthens the view stated above.

Chapter 30, Article 11, Section 2 defines "chiropody" as follows:

> "For the purpose of this article 'chiropody' shall mean the medical, mechanical or surgical treatment of the ailments of the human hand or foot, except the amputation of the foot, hand, toes or fingers, without the use of anaesthetics other than local. It shall also include the fitting or recommending of appliances, devices or shoes for the correction or relief of minor foot ailments."

It appears, therefore, from this definition that chiropodists are authorized to provide *medical*, mechanical or *surgical* treatment of diseases of the hand and foot, and are licensed to do so, and would therefore come within the meaning of the term, "duly licensed physician." See also, an opinion of this office, dated August 10, 1953, addressed to the Honorable John J. Yankiss, Prosecuting Attorney of Wood County, which states that a chiropodist is a physician within the meaning of the Uniform Narcotics Drug Act and is entitled to use narcotics in the treatment of his patients, and an opinion of this office, dated June 21, 1949, and printed in the Report and Opinions of the Attorney General, 1948-1950, page 296, which states that Chapter 31, Article 13 of the Code, contemplates the participation of licensed osteopaths in hospital service plans under that chapter.

In answer to the question as to whether medical service corporations licensed under Chapter 31, Article 13, are required to include, in any or

all contracts offered by it, provisions authorizing services from chiropodists, we feel obliged to note that there are no legal requirements, insofar as we have been able to determine, that provisions be made in a medical service contract for the treatment of any specific type of disease. Chapter 31, Article 13, Section 2 (5) reads as follows:

> " 'Medical service' shall mean only such medical and surgical care, to be provided by duly licensed physicians, or such payment therefor, as may be specified in the contract made by the subscriber with the corporation."

It will be noted that the treatment to be covered by the medical service is left by the statute to be specified in the medical service contract. We feel, therefore, that it is unnecessary to include a specific provision in a medical service contract authorizing service by a chiropodist, for, if the treatment covered by the medical service plan falls within the scope of what chiropodists are licensed to do, then, by authority of the statute, they would be included as they are "duly licensed physicians." If, on the other hand, the medical service contract does not include within its scope treatments which a chiropodist is authorized to give, he, of course, would have no right to receive payment from the medical service corporation.

We are therefore of the opinion that a chiropodist is a duly licensed physician and authorized to participate in medical service programs, under the provisions of Code 31-13, if the medical service contract includes within its scope those things which may be properly treated by a chiropodist. We are further of the opinion that a medical service contract is not necessarily required by law to contain any specific type of treatment and if the type of treatment offered by chiropodists is not included in the contract, they, of course, would have no right to participate in the program."

## MEMBERS ARE REQUESTED TO NOTE CORRECTION IN 1954 MEMBERSHIP DIRECTORY

**Members are requested to write in a correction on page 78 of the 1954 Membership Directory. Under the listing for OHIO, the city designation for "Toledo" is missing. Please write "Toledo" in the margin and draw a line under the name of "Weaver, E. L.," who is located in Struthers. All names shown under the name of Dr. Weaver are located in TOLEDO.**

## RELATION OF MAXIMUM GRIP STRENGTH TO GRIP ENDURANCE

STRENGTH has been measured by dynamometers of various types since their introduction by Brigham in 1872. In general, strength has been measured either as contraction or breaking strength, expressed as pounds or kilograms. Up to the present time the dynamometers employed provide for measuring maximum strength only. If one wishes to gain a complete picture of strength in man, it seems necessary to record not only maximum strength, but also the tension developed by a group of muscles over a period of time.

A dynamometer for measuring and recording maximum grip strength and strength endurance is described. In order to show the relationship between grip strength and grip strength endurance, data were collected from 200 university men between the ages of 20 and 30 years. The percentage of the maximum grip strength which was maintained for one minute (strength endurance) was correlated with maximum grip strength. The coefficient for the right hand was—0.40 and for the left—0.41. This suggests that stronger individuals can maintain a smaller proportion of their maximum strength than those with less initial strength. However, a correlation of maximum strength with the strength endurance index gave a coefficient of 0.67 for the right hand, and 0.66 for the left. This indicated that the individuals with the greater maximum strength have a greater strength endurance index.

*J. Applied Physiol. (June) 1950.*


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## ABSTRACTS AND HEALTH NEWS

### WHAT CAUSES YOUR HEADACHE?

In any one day, some 12,000,000 Americans are likely to complain of a headache. Perhaps 90 per cent of the pains are directly traceable to six common causes. The other 10 per cent, however, are chronic and may be symptomatic of any one of several serious ailments—kidney trouble, bad teeth, enlarged tonsils or some other infection. You shouldn't get upset over every mild headache but intense and recurring pains should not be neglected.

Fever and influenza are frequently preceded by headaches. In brain tumors, constant headache is often the first symptom of which the patient is aware. Hypertension can also produce a headache, with the excitable business man as a frequent victim. Doctors warn those afflicted to avoid fatigue, anger and excitement. Digestive upsets, usually caused by faulty diet, often result in headaches. And another common cause is eyestrain, which can bring pain to any part of the head, from the top of the skull to the nape of the neck. In this case, the simple cure is to wear properly prescribed glasses. Sometimes, too, overindulgence will give you a headache, but doctors say alcohol is only one cause of morning-after pain. Fatigue and excitement play a part. Also at the root of many headaches are sinus and nasal infections, occurring most often during the winter when sniffles are rampant.

*Better Living Jan.-Feb. 1952*

### MEDICAL TEACHERS

By a curious distortion of values capacity for teaching is more likely to be a handicap than a help to a young person who aspires to be a good clinical teacher. Perhaps this paradox results from failure to take seriously the main responsibility of a clinical chief, which is teaching. As medical teachers are chosen today with the eye asquint upon volume (and not necessarily quality) of published papers, it is accidental if superior talent for teaching adorns the odd assortment of characteristics demanded of medical department heads. No one has dared confront the curriculum head on and align it with the vast and incomprehensible array of new facts not yet codified in any sensible

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order. Always it is add another appendage. Unless a rival of integration permits wholesale pruning and sensible grafting, the academic tree, overburdened with miscellaneous fruit, will fall of its own weight and spoil the harvest.

*W. B. Bean, M.D., Jour. Lab. and Clin. Med., Jan. 1952*

## DENTISTS IN FIRST WORLD WAR

At a recent meeting of the Wisconsin State Dental Society, Brig. Gen. Louis H. Renfrow, deputy director of Selective Service, gave a report on the administration of Public Law 779. Dr. Renfrow is a member of the Army Dental Corps and presented figures on current and anticipated needs of military establishment for medical department officers.

## INFLUENCING OTHERS

Doctor Harry Overstreet, whose book, "The Mature Mind," was a long-time best-seller, points out the way to influence the behavior of others. "The way to get the other fellow to do what you want him to do," says Doctor Overstreet, "is first find out what he wants to do and see if what you are suggesting will help him to achieve it. Second, really like him; really think of him as your ally, not your opponent. Third, understand him. Fourth, believe heartily in what you are trying to do. Fifth, open your mind to the ideas of others, letting their ideas mix with yours to work out something mutually helpful.

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## ANTIFUNGAL AGENT

The antihistamine drug diphenylpyraline hydrochloride often alleviates fungous infections when other preparations are ineffectual. Among sensitive organisms are *Trichophyton gypseum, T. purpureum, Epidermophyton inquinale, Microsporum lanosum,* and *Monilia albicans.* A 2% diphenylpyraline solution in tap water or 2% ointment is employed by Dr. Oscar Sokoloff of New Brunswick, N. J. In a series of 153 cases, improvement was greatest with tinea pedis and almost as good with tinea cruris, tinea corporis, tinea axillaris, tinea capitis, and tinea versicolor.

*Arch. Dermat. & Syph. 64:754-756, 1951*

## N.A.C. DUES ARE PAYABLE NOW

## LONGEVITY OF PREHISTORIC MAN

It is only within comparatively recent times, historically speaking, that the data necessary for a true determination of the average length of human life have become available. Approximate estimates for earlier times must necessarily be based upon whatever fragmentary information has been brought to light by anthropological research. Thus, the longevity of prehistoric man has been estimated from the characteristic of fossil remains. On the basis of such meager evidence, it appears that the average length of life of prehistoric man was perhaps 18 years—a pitiful lease of life as measured by modern standards. This does not mean there were none surviving to mature life, but that the number of deaths in infancy and childhood were terrifyingly high. To judge by the large

proportion of preserved skulls that show traces of heavy blows, death by violence seems to have been a common occurrence at that period.

*Statistical Bulletin, Metropolitan Life Insurance Company.*

## LIBERAL EDUCATION

LIBERAL education should be designed to assist an individual to reach these objectives. If so, it appears to have four basic academic ingredients, which Professor Theodore M. Greene has outlined as follows: "(1) training in the accurate and felicitous use of language, as the essential condition of all reflection, self-expression, and communication with others; (2) training in the acquisition of factual knowledge of ourselves, our society and other societies, the physical world, and ultimate reality so far as it is humanly knowable; (3) training in mature and responsible evaluation and decision in the controversial areas of social policy, morality, art and religion, and (4) training in synoptic comprehension, i.e., in the escape from the multiple provincialisms which bedevil mankind and in the attainment of larger and more inclusive perspectives."

To admit the importance of these basic ingredients in a declaration in support of a broad liberal education as the best preparation in the liberal arts college for private living or public service. It follows also that "each of the academic disciplines traditionally identified with the standard departments of our American college faculty must, in its own way, concern itself with the essential skills of an educated man. Each discipline, on the other hand, does, or should, make a contribution of special value in one or another of these four regions."

*A. E. Severinghaus, Ph.D.*

## STERILIZATION OF INSTRUMENTS

Two items which can be used effectively for sterilization of instruments have recently been introduced. One is a cellulose sheath which comes in 40-foot lengths which is telescoped on itself so that each stick is nine inches long. Instruments are inserted into the sheath which will completely cover them. Sheaths may be cut to proper lengths and the ends can be twisted to give complete enclosure when placed in a sterilizer or autoclave. When sterilization is completed, the instrument remains in the sheath until ready for use. Single instruments may be removed without touching others in the enclosed package.

A silicon spray in the form of an aerosol bomb is available. Instruments are sprayed with the solution which coats the instrument and prevents rust.

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## ORGANIZATION NEWS

### *RHODE ISLAND*

At a recent meeting of the Rhode Island Chiropodists' Society, the following officers were elected:

Honorary President, Dr. C. N. Johnson
President, Dr. Joseph P. Markowitz
President-elect, Dr. William Proulx
Vice Pres., Dr. Joseph O'Rourke
Secretary, Dr. Samuel Kouffman
Treasurer, Dr. Myron Keller
N.A.C. Delegate, Dr. James Hamilton
N.A.C. Alternate, Dr. Clinton C. Brady
Member, Board of Directors: Dr. B. Shaffer, Dr. F. Fisher, Dr. A. C. Moran, Dr. G. G. Feinberg, Dr. C. C. Brady, Dr. J. L. Martin

### *NEW HAMPSHIRE*

At the recent annual meeting of the New Hampshire Chiropody Association, the following officers were elected:

President, Dr. Margaret King Schmidt
First Vice President, Dr. Robert Cingolani
Second Vice President, Dr. Arthur Bosa
Secretary-Treasurer, Dr. T. M. Levinston

The program featured lectures by R. Griffin, Dr. A. P. Chambadhis, Dr. S. White, Dr. J. Hamilton, Dr. I. Yale, Dr. L. T. Bennett and Dr. R. Rix.

Dr. Robert O. Blood, former governor of New Hampshire, was the guest speaker at the official banquet. The following committee arranged the program: Drs. R. C. Descoteau, T. K. Lalos, F. A. O'Brien.

A report on the second annual foot health examination of school children was presented.

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## SYMPOSIUM SPONSORED BY PHILADELPHIA GROUPS

A SYMPOSIUM is scheduled to be held under the sponsorship of the Philadelphia Chiropody Society and the North Philadelphia Chiropody Society at the Essex Hotel, Thirteenth and Filbert Sts., Philadelphia, on Sunday, October 3, 1954.

## NEW DIRECTOR OF JOINT COMMISSION ON ACCREDITATION OF HOSPITALS

KENNETH B. BABCOCK, M.D., became director of the Joint Commission on Accreditation of Hospitals on July 1st. There is perhaps no more vital program than this effort by doctors and by hospitals constantly to elevate hospital care standards by a vigorous and voluntary method of self-discipline. . Dr. Babcock's career as a physician, surgeon, and hospital administrator has well prepared him for his present post. He was born in Bath, N. Y., and was educated in Michigan. After a residency, he entered the practice of surgery in Detroit in 1928 and became a member of the staff of Grace Hospital. He earned his fellowship in the American College of Surgeons in 1938 but turned to hospital administration three years later when he became assistant director at Grace Hospital. He became its director in 1947, serving in this position until his resignation to accept the Joint Commission assignment. In World War II, he served with the Army's 15th field hospital in Africa and Italy and was awarded the Bronze Star medal.

## CALIFORNIA COLLEGE SPONSORS SEMINAR

THE Eighth Annual Seminar, sponsored by the California College of Chiropody, will be held November 5-8, 1954, in San Francisco and on November 11-14 in Los Angeles. Registration fee for N.A.C. members is $35.00, and Associate members $10.00. Practitioners are requested to register early. Checks should be sent to the California College of Chiropody, 1770 Eddy Street, San Francisco, Calif.

Among the subjects to be presented by Dr. Raymond K. Locke of Englewood, N. J., will be the treatment of onychocryptosis, onychomycosis, skin growths and foot imbalance, injection therapy, traction therapy, and roentgen interpretation.

Dr. Philip Brachman of Chicago, Ill., will present treatment of orthopedic conditions, the prescription and construction of shoe corrections and appliances for problem and deformed feet.

All lectures will be accompanied by actual case demonstrations over TV equipment where possible. Slides and films will be shown.

Dr. Charles S. Ormond is Seminar Chairman, and Dr. Charles DiPilla is acting as Southern California Registrar.

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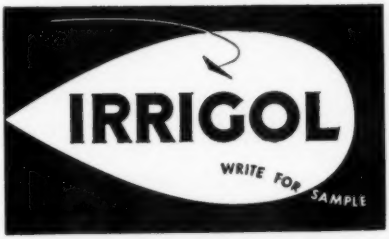


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Kansas City, Mo., Oct. 9-10, 1954
Hotel President

REGION ONE
Boston, Mass., Oct. 10-12, 1954
Sheraton Plaza Hotel

**1955**

REGION SIX
Minneapolis, Minn., April 2-4, 1955
Nicolett Hotel

NATIONAL ASSOCIATION OF CHIROPODISTS
Cleveland, Ohio, August 11-16, 1955
Hotel Statler

## DEATHS REPORTED

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